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LONGWOOD MEDICAL AREA TRANSPORTATION STUDY

Medical Area Service
Corporation (MASCO)

Vanasse Hangen Brustlin, Inc.

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TECHNICAL MEMORANDUM #2

Five Year Growth Horizon
April, 1988

LONGWOOD MEDICAL AREA
TRANSPORTATION STUDY

TECHNICAL MEMORANDUM #2
FIVE YEAR GROWTH HORIZON

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April, 1988

prepared for

MEDICAL AREA SERVICE CORPORATION
(MASCO)

by

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TABLE OF CONTENTS

Page

I. INTRODUCTION 1

II. FIVE-YEAR GROWTH PROJECTION 2

A. Land Use Forecast for LMA Institutions 2
B. New Developments Unrelated to LMA Institutions 4

III. IMPACT ASSESSMENT 6

A. Traffic Generation for Institutional Land Use Changes 6
B. Through Traffic Generation 8
C. Estimated Parking Demand 9
D. Impacts on LMA Arterial Intersections 11

IV. SUMMARY AND CONCLUSION 13

A. Summary 13
B. Conclusion 13

I. Introduction

I. INTRODUCTION

The first phase of the Longwood Medical Area (LMA) Transportation Study involved the documentation and analysis of existing conditions and the preparation of Technical Memorandum #1, entitled "Summary of Existing Conditions." That report, drawing on institutional land use and employment data provided by MASCO, field observations of the LMA transportation system, and a survey of automobile users on LMA arterials, presented the most comprehensive analysis to date of transportation supply, demand and level of service in the LMA. One of the report's conclusions was that LMA arterial roadway intersections are severely taxed by existing traffic volumes, of which an estimated 65 percent are through traffic.

The second phase of the study, described in this technical memorandum, involved forecasting land use changes inside and outside the study area during the coming five years, estimating the resulting traffic volumes, and analyzing their impacts on selected intersections.

Finally, the third phase of the study, to be described in a subsequent report, presents an evaluation of alternative transportation improvements to meet the growing needs of the Longwood Medical Area.

II. Five-Year Growth Projection

II. FIVE-YEAR GROWTH PROJECTION

A. Land Use Forecast for LMA Institutions

A five-year land use forecast was developed from a 1987 MASCO survey of its member institutions and refined by MASCO in consultation with institutional representatives. The following criteria were used to decide which potential land use changes should be included in the forecast. All projects approved by the Boston Redevelopment Authority were included; some of these are currently under construction. Projects which were recently completed were included if they were not occupied when the baseline traffic counts were taken in early 1987. Proposed land use changes which have not been approved by the BRA were nevertheless included in the forecast if it was judged that they would, more likely than not, be approved and completed within five years. As a result of these criteria, the proposed development on the Massachusetts College of Art site on Brookline Avenue was excluded because it is unlikely to be completed and occupied in five years. On the other hand, some of the land use changes included in the forecast (and therefore in the traffic forecast) might well not actually occur, because plans are not definite, institutional needs might change, or necessary state and city approvals might not be obtained. Although the use distribution of the new space is even less definite than the square footage, transportation demand forecasting is based on types of uses and hence requires that a use distribution be estimated. The estimates of land use changes assumed in this study are given in Table 1.

TABLE 1
LAND USE ESTIMATES

	Gross Floor Area (Square Feet)	
Use	BRA-Approved*	Proposed
Research	262,000	284,000
Inpatient	0	16,000
Outpatient	85,000	-19,000
Nursing School	-85,000**	0
General Office	27,000	75,000***
Retail	38,000	20,000
Hotel	31,000	0
Child Care	0	7,000
Total	358,000	383,000

* Includes projects which are under construction or recently completed.

** Negative number reflects the planned elimination of this existing use.

*** Includes 50,000 square feet outside the LMA.

New parking supply has been proposed at several sites in or near the LMA, and several parking facilities are already under construction or have recently opened. While some facilities are not definite, this study assumes the creation of almost 1,800 net new spaces as shown in Table 2.

TABLE 2
NET NEW PARKING SUPPLY ESTIMATES

Site	Final Supply	Existing Supply	Net New Supply
Temple Israel	750	225	525
Ruggles (Triangle)	375	200	175
Blackfan St. (Children's)	400	0	400
Blackfan St. (Harvard)	450	125	325
Emmanuel Deck	360	220	140
Galleria	200	128	72
ASB II (Brigham & Women's)	240*	0	240
Deaconess Lots	0	90	-90**
Total	2,775	988	1,787

* Recently opened.

** Negative number represents a decrease in parking supply.

B. New Developments Unrelated to LMA Institutions

The LMA's transportation system is profoundly affected by activities occurring outside the LMA. Since approximately 65 percent of existing peak hour traffic on LMA arterials is through traffic, it is important to forecast external land use changes and estimate their impacts on the LMA roadways.

The development of Parcel 18 just east of the LMA will have a significant effect on LMA traffic volumes. For this study, 500,000 square feet of office space, 100,000 square feet of retail space, and 150 housing units were assumed for Parcel 18, based on information obtained by MASCO from the BRA. The 571-car parking garage currently under construction at the Museum of Fine Arts was also included.

New developments farther away from the LMA will also contribute to LMA traffic. Based on studies conducted by Vanasse Hangen Brustlin and others, five-year employment growth forecasts were developed for downtown Boston, Back Bay, and Cambridge. The cumulative growth rates were estimated as 12 percent for downtown, 5 percent for Back Bay and 10 percent for Cambridge.[1] [2]

While the Sears site is likely to be developed to a higher use intensity than the existing building, the plans were deemed too indefinite and long-range to be accounted for in this five-year forecast.

1/ Skidmore, Owings & Merrill, "Downtown Development Scenario for 1995 and 2010, prepared for Massachusetts Port Authority, May 23, 1986.

2/ Skidmore, Owings & Merrill and Vanasse Hangen Brustlin, University Park, Final Environmental Impact Report, EOEA #5487, April 1987.

III. Impact Assessment

III. IMPACT ASSESSMENT

A. Traffic Generation for Institutional Land Use Changes

Vehicle-trip generation estimates were developed from a variety of sources depending on the type of land use. For research, office, retail, and hotel space, the rates were taken from several reports prepared by Vanasse Hangen Brustlin, Inc., in connection with proposed developments in the LMA. These developments include the Galleria, the Children's Research Expansion project, and the Temple Israel Site Mixed-Use Development. The vehicle-trip rates used in these earlier studies were derived from empirical data supplied by the Institute of Transportation Engineers (ITE). The ITE rates were adjusted to reflect the higher incidence of transit and walk trips documented in surveys conducted in the LMA. For inpatient space, rates were derived from a door count conducted by security personnel at the Brigham and Women's Hospital in the Spring of 1987. For outpatient space, several sources were consulted, including ITE, the MASCO survey of its member institutions, and a traffic study performed for the New England Deaconess Hospital by Norman Abend Associates. The resulting vehicle-trip generation figures are presented in Table 3.

As shown in the table, approximately 4,000 new daily vehicle-trips are expected to be generated by the new LMA land uses. About 440 (22 percent) of the entering trips will occur during the AM peak hour, while about 420 (21 percent) of the exiting trips will occur in the PM peak hour. Adding entering and exiting trips, approximately 550 (14 percent) of all daily vehicle-trips are expected to occur during each peak hour.

TABLE 3
PROJECTED VEHICLE-TRIP GENERATION FOR ESTIMATED LAND USE CHANGES (1987-1992)

			AM PEAK HOUR		PM PEAK HOUR	
		Daily	In	Out	In	Out
Research	Work	904	196	5	5	147
	Non-Work	200	22	22	22	22
	Total	1,104	218	27	27	169
Inpatient	Work	48	5	1	0	5
	Non-Work	148	5	1	3	6
	Total	196	10	2	3	11
Outpatient	Work	132	17	1	1	17
	Non-Work	792	40	40	40	40
	Total	924	57	41	41	57
Nursing School*	Work	-42	-8	0	0	-8
	Non-Work	-8	-2	-1	-1	-2
	Total	-50	-10	-1	-1	-10
Office	Work	704	125	2	2	125
	Non-Work	380	6	20	22	23
	Total	1,084	131	22	24	148
Retail	Work	192	3	2	12	12
	Non-Work	150	2	2	9	9
	Total	342	5	4	21	21
Hotel	Work	50	12	1	6	6
	Non-Work	294	7	8	6	6
	Total	344	19	9	12	12
Childcare	Work	28	7	0	0	7
	Non-Work	42	6	6	6	6
	Total	70	13	6	6	13
All uses	Work	2,016	357	12	26	311
	Non-Work	1,998	86	98	107	110
	Total	4,014	443	110	133	421

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* Negative numbers reflect the planned elimination of this existing land use.

The geographic distribution of the new trips to and from the LMA during peak hours was based on information gathered during the May 1987 Auto User Survey. Work trips and non-work trips were assigned separate distributions because the geographic distribution of LMA workers is different from that of clients and visitors. The difference is illustrated in Table 4, which displays the distribution of peak hour trips by major corridor.

TABLE 4
DISTRIBUTIONS OF WORK AND NON-WORK TRIPS

	Work		Non-Work	
	AM	PM	AM	PM
Jamaicaway	24%	22%	26%	13%
Route 9 West	21%	24%	16%	21%
Longwood, Park Drive West	24%	19%	15%	23%
Kenmore, Storrow, Turnpike	22%	19%	36%	34%
All Others	9%	16%	7%	9%
Total	100%	100%	100%	100%

B. Through Traffic Generation

1. Downtown Boston, Back Bay, and Cambridge

Analysis of the automobile user survey conducted by Vanasse Hangen Brustlin (VHB) in May 1987 yielded estimates of the percentages of peak hour traffic on LMA arterials which is traveling to or from downtown Boston, Back Bay and Cambridge. Based on studies conducted by VHB and others, five-year cumulative employment growth rates for these three areas were estimated

at 12 percent for downtown Boston, 5 percent for Back Bay, and 10 percent for Cambridge. By applying these growth rates to that portion of LMA traffic traveling to or from these areas, the traffic generation of developments in those areas was estimated.

2. Ruggles Street Area

Vehicle-trips for Parcel 18 were estimated by the methodology used for LMA land use changes. Traffic volume changes resulting from the Museum Garage Project were taken from an earlier VHB report on that project.

3. Resulting Increases in LMA Through Traffic

The total new through vehicles using one or more LMA arterials is estimated to be 5,000 each weekday, including 450 in the AM peak hour and 640 in the PM peak hour. As shown in Table 5, the daily and PM peak hour figures are greater than the vehicle-trips estimated for new LMA land uses.

TABLE 5
SUMMARY OF PROJECTED NEW VEHICLE TRIPS

	LMA Land Uses	Non-LMA Land Uses	Estimated Total
Daily	4,014	5,000	9,000
AM Peak	553	450	1,000
PM Peak	554	640	1,200

C. Estimated Parking Demand

Growth in parking demand related to LMA institutions was estimated based on three turnover rates. The turnover rate is the average number of vehicles using a single parking space over a 24-hour period. For work trips generated by land uses other

than inpatient uses, a turnover rate of 1.0 vehicle per space per day was assumed, because those work trips are overwhelmingly day shift. For work trips generated by new inpatient-related activity, a turnover rate of 2.8 cars per space was used, based on observed utilization of monthly-permit spaces at the Beth Israel Hospital Garage. For all non-work trips, a turnover rate of 3.3 cars per space was used since this rate has been observed at non-monthly spaces at both the Beth Israel and Servicenter Garages. Table 6 shows the derivation of the parking demand estimate of 1,296 spaces for the projected institutional land use changes.

TABLE 6
ESTIMATED NEW PARKING DEMAND

	Vehicle Trips*	Vehicles	Assumed Turnover Rate	Parking Demand
Work Trips:				
Inpatient Use	48	24	2.8	9
Other Uses	1,968	984	1.0	984
Non-Work Trips:	1,998	999	3.3	303
Total	4,014	2,007		1,296

* Total of arriving and departing trips.

There is considerable uncertainty with respect to both the demand and supply projections; 51 percent of the forecast land use changes and 88 percent of the estimated parking supply changes have not received Boston Redevelopment Authority approvals. Furthermore, the demand for patient and visitor parking at existing medical facilities appears to be growing due to increases in the number of patients served.

Despite these uncertainties, it appears that the net new parking demand of approximately 1,300 spaces can be met by the proposed new parking supply of 1,787 spaces presented earlier in Table 2. Moreover, it appears that there is the potential to remove some on-street metered spaces to help alleviate traffic congestion on LMA arterials, while still adequately accommodating the increased demand for parking.

D. Impacts on LMA Arterial Intersections

To estimate the impact on LMA arterials of forecast land use changes inside and outside the LMA, the through trips were first assigned to roadway segments and intersections for each peak period. Next, the LMA-generated new vehicle-trips were assigned and assumed to travel to the proposed new parking spaces. Some day-shift workers assigned to parking at the Ruggles Street site and the Blackfan Street sites were routed via the Temple site to model the impacts of child care drop-offs and pick-ups.

Nine key intersections initially analyzed in Technical Memorandum #1 were reanalyzed assuming the increased traffic volumes and the existing signal phasing and timing. The results, presented in Table 7 and in Figures 1, 2 and 3, showed significant deterioration in level of service and delay at these intersections. In some cases, it is only one move (e.g., a left-turn) that is significantly delayed, and in some of these cases a simple change of signal timing or phasing can mitigate the impact. Still it is noteworthy that if no improvements are made, the number of intersections with Level of Service "F" will increase from one to six out of nine in the AM peak hour and from one to five out of nine in the PM peak hour.

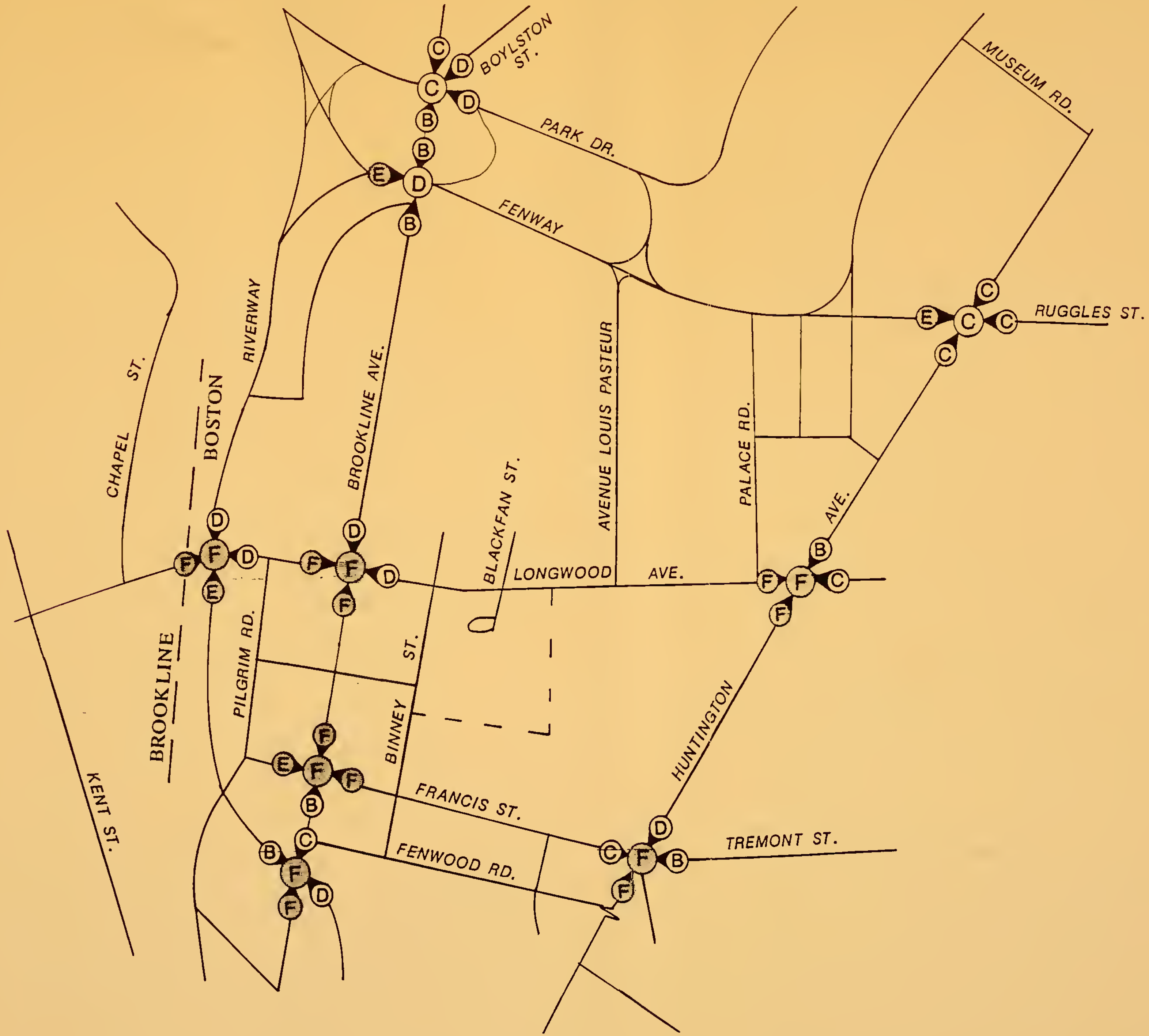
TABLE 7
LEVEL-OF-SERVICE ANALYSIS

	AM Peak Hour						PM Peak Hour					
	V/C		Delay (sec)		LOS		V/C		Delay (sec)		LOS	
	1987	1992	1987	1992	1987	1992	1987	1992	1987	1992	1987	1992
Brookline Ave./Boylston St./Park Dr.	0.79	0.84	19	21	C	C	0.89	0.95	26	34	D	D
Brookline Ave./Fenway*	0.68	0.71	21	29	C	D	0.68	0.74	18	30	C	D
Brookline Ave./Francis St.	1.01	1.56	17	183	C	F	0.81	0.84	20	30	C	D
Brookline Ave./Longwood Ave.	0.93	1.33	27	170	D	F	0.85	1.05	50	102	E	F
Brookline Ave./Riverway	1.07	1.20	60+	60+	F	F	1.08	1.20	60+	60+	F	F
Huntington Ave./Francis St.	0.76	0.90	24	92	C	F	0.94	0.90	58	59	E	E
Huntington Ave./Longwood Ave.	0.89	1.05	28	85	D	F	0.98	1.02	32	86	D	F
Huntington Ave./Ruggles St.	0.61	0.80	17	23	C	C	0.84	1.24	36	166	D	F
Longwood Ave./Riverway**	0.75	0.98	40	99	D	F	0.97	1.23	43	122	E	F

* Standard analysis methods tend to under-estimate delays at this location due to the effect of the Riverway merge just west of the intersection.

** Standard analysis methods tend to under-estimate delays at this location due to the lack of coordination with nearby signals in Brookline.

Forecast Intersection Level of Service A.M. Peak Hour



LEGEND:
○ Intersection Level of Service
▲ Approach Level of Service

NOTE: Shading Indicates Deficient Location

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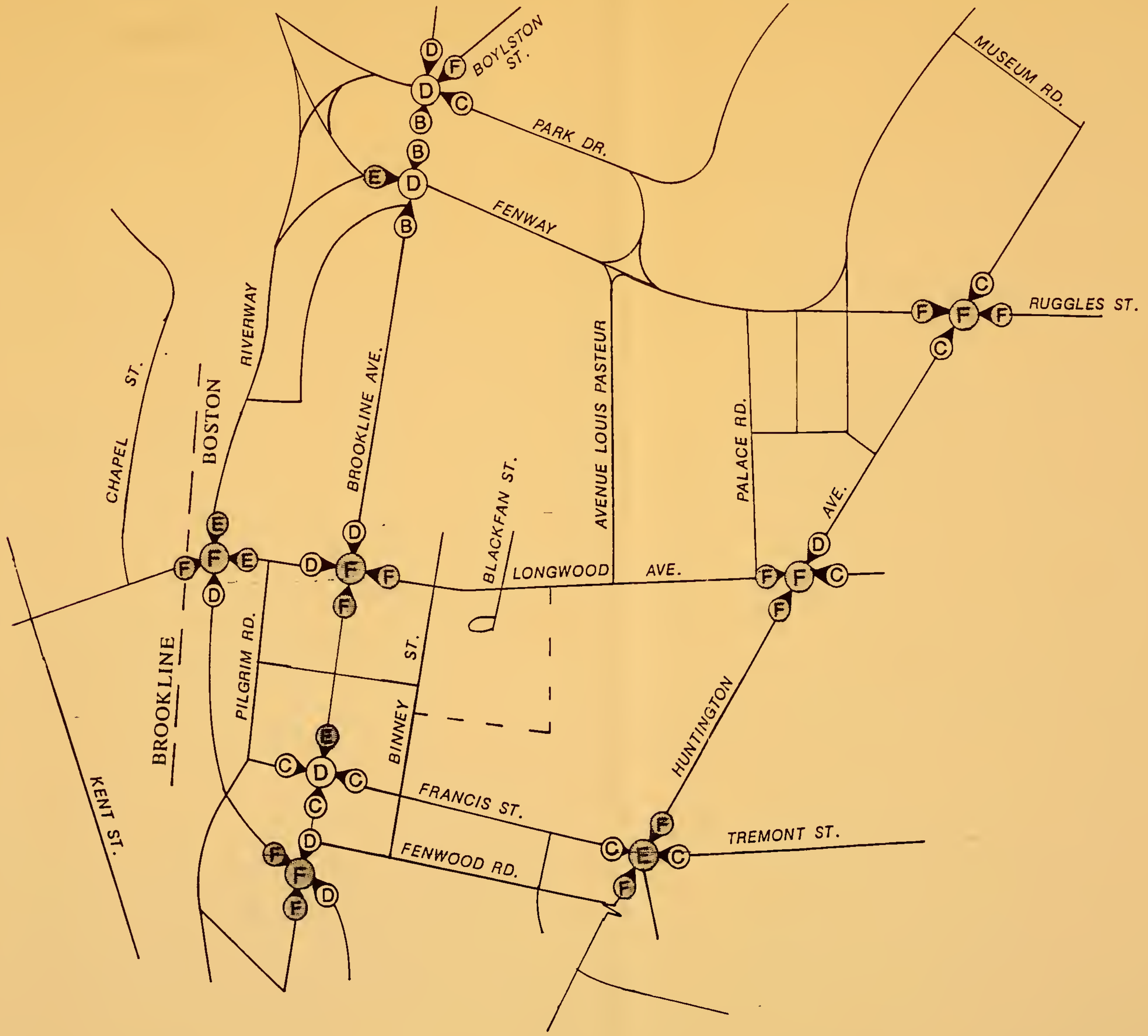
Not to Scale

Fig. 1

Forecast Intersection Level of Service P.M. Peak Hour



LEGEND:
○ Intersection Level of Service
▲ Approach Level of Service

NOTE: Shading Indicates Deficient Location

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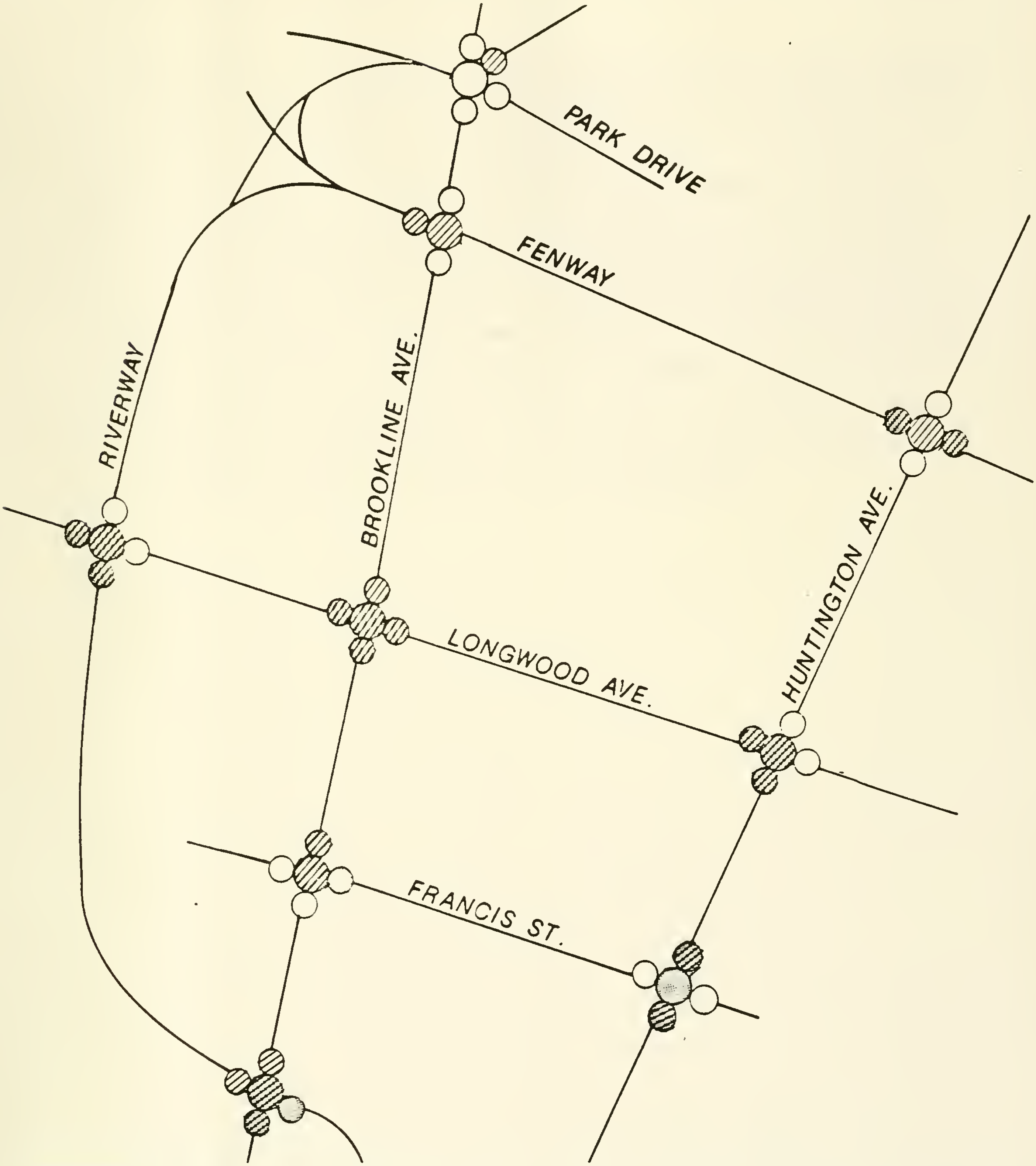
Fig. 2



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Peak Hour Level of Service Declines

LEGEND:

- ○ Intersection Level of Service
- ○ Approach Level of Service
- ○ Decline in A.M. Peak Hour
- ▨ Decline in P.M. Peak Hour

Not to Scale

Fig. 3

High left-turn volumes crossing heavy opposing traffic appear to be largely responsible for the deficiencies in forecast level of service at the analyzed intersections. The LMA arterials generally lack the exclusive left-turn lanes typically found on suburban arterials; yet, the one-way street patterns which aid left-turn flows in a typical central business district are also lacking in the LMA. The only locations with acceptable intersection level of service in both peak hours are the intersections of Brookline Avenue with Park Drive and the Fenway (a one-way pair) where there are no opposed left turns. On the Riverway, left-turn problems are compounded by very heavy volumes of regional through traffic (over 80 percent of all vehicles).

IV. Summary and Conclusion

IV. SUMMARY AND CONCLUSION

A. Summary

The planned new development in the LMA and a projected addition of almost 1,800 parking spaces will generate approximately 4,000 new daily vehicle-trips, of which an estimated 550 will occur during each of the two daily peak hours. Developments outside the LMA, including about 750,000 square feet in the Ruggles Street area and much more in downtown Boston, Back Bay, and Cambridge, will place an additional 5,000 daily vehicle-trips on LMA arterials, including 450 and 640 in the AM and PM peak hours, respectively. As a result, traffic level of service will deteriorate to "F" at five out of nine analyzed LMA intersections in the AM peak hour and on four out of nine in the PM peak hour, if no improvements are implemented.

B. Conclusion

The final phase of this study involves evaluation of over 50 potential strategies for improving traffic/transportation conditions in the LMA. The strategies include roadway construction projects, roadway and intersection improvements not requiring construction, traffic circulation changes (such as one-way streets and turn prohibitions), and traffic reduction strategies. The final technical memorandum will consist of an evaluation of all identified strategies and recommendation of short-range and long-range priorities.

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